Upper Sand Creek Basin
Contra Costa County Flood Control and Water Conservation District
Economic Analysis – Flood Damage Reduction

The following section present a quantitative and qualitative analysis of project costs and flood damage reduction benefits for the Upper Sand Creek Basin Project (USCB or Project). Flood damage reductions were calculated using the Flood Rapid Assessment Model (FRAM) developed for the California Department of Water Resources (DWR). Table 4 is included at the end of this section.

Overview and Project Linkages

The primary purpose of the Project is to prevent flooding along the lower reach of Marsh Creek between Sand Creek, in Brentwood, and the Marsh Creek confluence with the Sacramento-San Joaquin River at Big Break, in Oakley. The regional goal for USCB is to significantly reduce peak flows from Sand Creek into Marsh Creek, thereby reducing the flood-related risks and damages associated with a variety of storm frequency/severity events. It also will improve water quality in these receiving waters, by capturing sediment and other nonpoint source pollution carried by storm events.

The Project consists of creating a detention basin that will capture upstream flows up to and including the 100-year storm event (920 acre-feet of storage capacity). This detention basin will be created by enlarging an existing smaller detention basin that is currently not connected to the creek and therefore adds no direct capture and detention of upstream stormwaters. The enlarged basin will be hydrologically connected to the stream channel and will thus capture stormwater flows up to the 100-year 6-hour storm event. Local stormwater runoff and stormwater generated in the watershed will be conveyed by Sand Creek to the basin where it will be stored and released slowly through the basin outlet, reducing peak flows downstream and reducing the potential for flooding downstream properties. Secondary purposes of the basin include habitat restoration and water quality enhancements.

The USCB project is a stand-alone project, and does not depend upon other projects to provide the benefits described. This project protects Delta water quality by eliminating flood waters which would otherwise transport pollutants from an urbanized area to the Delta. By preventing contaminated flood waters from reaching the Delta, the sensitive Delta ecosystem is protected.

A summary of all benefits and costs of the project are provided in Table 1.

Table 1.
Benefit Cost Analysis Overview

	Present Value
Costs – total Capital and O&M	$11.74 M
Monetizable Benefits	
Flood Control Benefits: Avoided losses in property damages (FRAM)	$27.9 M
Total Monetized Benefits	$27.9 M

Qualitative Benefit or Cost	Qualitative Indicator*
Avoided traffic delays due to key road inundation	+
Avoided emergency response cost during floods	+
Water Quality and Other Benefits	+
Improved Surface Water Quality	+
Improved Riparian Habitat	+
Recreational and Aesthetic Benefits	+
Increased Housing Values Near New Park Acreage	+
Avoided Permitting Costs	+

O&M = Operations and Maintenance
*Direction and Magnitude of Effect on Net Benefits:
+ = Likely to increase net benefits relative to quantified estimates
++ = Likely to increase net benefits significantly
- = Likely to decrease benefits
- - = Likely to decrease net benefits significantly
U = Uncertain, could be + or -

Economic Costs

Capital costs for the project amount to $11.74 M in present value terms, as shown in Table 4. This includes initial capital spending starting in 2011 and continuing through 2015. The project lifetime is expected to be 50 years, and an annual cost of $50,000 is expected to cover maintenance activities such as weed abatement, inspection and maintenance of the dam structure, monitoring and maintenance of the riparian restoration area (adaptive management), and maintenance of the inlets (trash removal) and emergency outlets (maintenance of the gate and emergency spillway). These costs are anticipated to begin in 2016, following project completion in 2015.

Estimates of Historical Flood Damage

The area below the proposed USCB consists of Sand Creek (which provides little to no flood protection from relatively minor storms). Sand Creek enters into Marsh Creek, which has engineered banks intended to protect adjacent areas from flooding up to a 50-year event.

The area at risk covers over 12,000 acres of eastern Contra Costa County, and includes residential developments (nearly 2000 homes), as well as over 250 commercial, industrial and institutional buildings, agricultural lands, and numerous arterial roads (including Highway 4) and bridges. Figure 3 (attached) shows the area at risk.

Property tax assessment records indicate the value of existing properties in the 100-year floodplain of these creeks amounts to $759 million. These tax assessment figures are likely to

understate the true market value of these properties, and do not include the value of contents and other personal property that may also be at risk in these neighborhoods.

Approximately 15 percent of the properties at risk are located along Sand Creek ($112.4 million at risk = 15 percent of $749 million), and the remaining 85 percent of the at risk property values ($636.7 million = 85 percent of $749 million) are located in the areas subject to flooding from Marsh Creek.

Sand Creek Area Damage Risks

Without the project, the properties along the Sand Creek portion of the watershed will continue to flood regularly from a wide range of storm events. Specific flood event frequency and associated damage estimates are not available, but regional experts indicate that it is reasonable to assume the following as baseline conditions.

- A 10-year event would conservatively be associated with a 2 percent probability of flooding in this area, with an associated damage loss of at least 2 percent of the property values at risk. Thus, the expected loss in a 10-year event is conservatively estimated as $45,568 ($112.4 million*0.02*0.02).
- A 50-year event would be associated with a 50 percent probability of flooding in this area, with an associated damage loss of at least 5 percent of the property values at risk. Thus, the expected loss in a 50-year event is conservatively estimated as $5.7 M ($112.4 million*0.05).
- A 100-year flood event would conservatively be associated with a 100 percent probability of flooding in this area, with an associated damage loss of at least 10 percent of the property values at risk. Thus, the expected loss in a 100-year event is conservatively estimated as $11.2 million ($112.4 million*0.1).
- While the 10- and 50-year events would not cause road inundation, the 100-year event would result in extensive road inundation. Road inundation was calculated utilizing GIS mapping of 100-year flood zone and measurement of the roads flooded. Based on this analysis, the following road distances would be inundated in a 100-year event: 17.3 miles of arterial roads, 3.0 miles of major roads, 36.0 miles of minor roads, and 11.4 miles of unsealed roads.

Marsh Creek Area Damage Risks

At baseline, Marsh Creek properties are generally protected from all events up to and including 50-year storms. However, without the project, the $636.7 million in property value does remain at risk to storms of severity greater than the 1-in-50 year event. For example, in a 100-year event with a 100 percent of failure (flooding over the banks) and assuming damages amounting to 10 percent of assessed values, a loss would be incurred of over $63.7 million ($636.7 million *0.1).

Description of Expected Flood Reduction Benefits

Significant flood reduction benefits are expected to be generated by the proposed expansion of the basin to accommodate (retain and manage a controlled release) stormwater runoff up to and including a 100-year event. These benefits are summarized below.

Summary of Benefits

With the USCB project, all of the flood-related damages described above, for baseline conditions, would be eliminated. The annual average flood damage reduction benefits, as well as their present worth, were estimated. To be conservative, we assumed that the detention basin had a 2 percent chance of failure for the 10-year or 50-year event, and a 5 percent chance of failure in the 100-year event.

Avoided flood damage has been monetized using the DWR's Flood Rapid Assessment Model (FRAM). Using the assumptions above, the FRAM model calculated an annualized flood damage reduction benefit (the change in expected annual benefits) of 1.8 million, which amounts to a present value of $27.9 million when discounted over 50 years at 6 percent. Results are summarized in Table 5.

Project Beneficiaries and Distribution of Benefits

The proposed USCB project includes a full range of beneficiaries, as summarized in Table 2. At the local level, residents and business owners within the affected portions of the Sand Creek and Marsh Creek watersheds will benefit from reduced flooding. In addition, contaminated flood waters will no longer flow through this area and to the Delta, providing Delta water quality benefits at the regional and statewide level.

Table 2.
Project Beneficiaries Summary

Local	Regional	Statewide
Sand Creek and Marsh Creek Watershed Residents and Businesses	Sacramento-San Joaquin Bay-Delta	Sacramento-San Joaquin Bay-Delta

Timing of Benefits

The USCB project will be implemented over a five-year period from 2011 through 2015. It is assumed that the full flood protection benefits, up to the 100-year event, will be realized immediately on completion of the dam and basin in 2012. For the purposes of this analysis, we have assumed a project life of 50 years. In reality, however, it is likely that the project life will extend beyond that horizon, making the estimated $27.9 M in benefits over the project life a conservative estimate.

Uncertainty of Benefits and Adverse Effects

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In most cases, omissions lead to a downward bias in benefits. Some uncertainty exists in the life of the facility and precise extent of property damage and cleanup costs with each storm interval. However, the assumptions incorporated in this analysis have been scaled back to intentionally provide a conservative estimate of benefits. These issues are listed in Table 3.

Table 3.
Omissions, Biases, and Uncertainties, and Their Effect on the Upper Sand Creek Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Facility Life	+	Facility life was assumed to be 50 years; however it is likely that the facility life will be much longer. Should the facility life be longer than assumed, actual benefits will be greater than estimated.
Property Values and Damage	+	As stated in the text, the region has experienced rapid growth in recent years, and the exact extent of damage incurred in different storm events is largely unknown. Conservative estimates were used in this analysis, and it is expected that the actual benefits associated with avoided property damage are greater than current estimates.
Cleanup Costs	+	Cleanup costs were not included in this analysis. It is anticipated that the addition of cleanup costs to the analysis would increase the present value of project benefits.

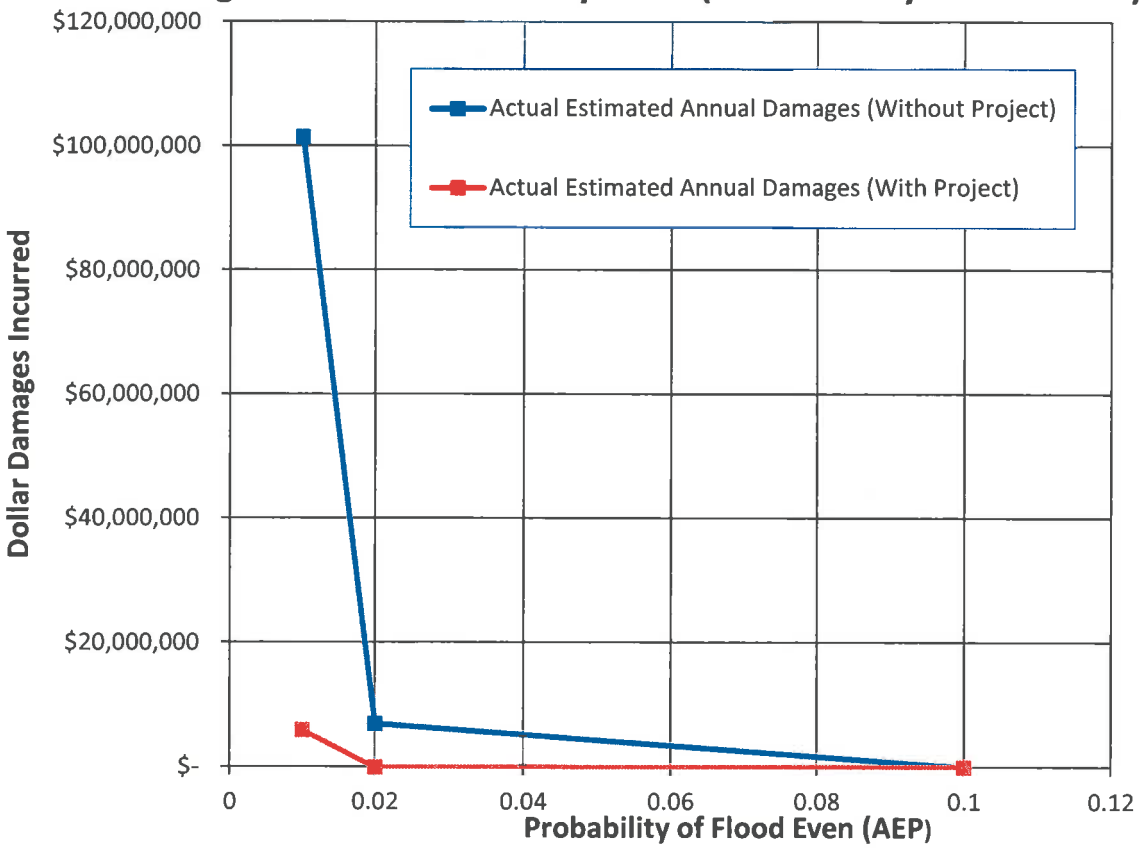
*Direction and Magnitude of Effect on Net Benefits:
+ = Likely to increase net benefits relative to quantified estimates
++ = Likely to increase net benefits significantly
- = Likely to decrease benefits
- - = Likely to decrease net benefits significantly
U = Uncertain, could be + or -

Economic Benefit Tables

Capital costs for the project amount to $11.74 million in present value terms, as shown in Table 4. This includes initial spending starting in 2011 and continuing through 2015, as well as $50,000 per year in maintenance costs for the life of the project. The project lifetime is expected to be 50 years, with the project completed in 2015.

As described above, flood damages were estimated using the FRAM. Figure 1 presents the loss-probability curve developed for the project using the FRAM model. Table 5 presents the results of the FRAM analysis. Based on this analysis, using a project life of 50 years and a 6 percent discount rate, the present value of expected benefits is estimated to be $27.9 million.

Figure 1.: Loss Probability Curve (Generated by FRAM Model)



Contra Costa County Flood Control & Water Conservation District

Table 4
Economic Costs, Upper Sand Creek Basin

	Intial Costs	Operations and Maintenance Costs						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Year	Grand Total Cost	Adminstation	Operations	Maintenance	Replacement	Other	Total Costs (a) +...+ (F)	Discount Factor	Discounted Costs (g) x (h)
2009							$ -	1.000	$ -
2010							$ -	0.943	$ -
2011	$ 143,100						$ 143,100	0.890	$ 127,359
2012	$ 8,768,767						$ 8,768,767	0.840	$ 7,365,764
2013	$ 4,111,600						$ 4,111,600	0.792	$ 3,256,387
2014	$ 298,267						$ 298,267	0.747	$ 222,805
2015	$ 298,267						$ 298,267	0.705	$ 210,278
2016				$ 50,000			$ 50,000	0.665	$ 33,250
2017				$ 50,000			$ 50,000	0.627	$ 31,350
2018				$ 50,000			$ 50,000	0.592	$ 29,600
2019				$ 50,000			$ 50,000	0.558	$ 27,900
2020				$ 50,000			$ 50,000	0.527	$ 26,350
2021				$ 50,000			$ 50,000	0.497	$ 24,850
2022				$ 50,000			$ 50,000	0.469	$ 23,450
2023				$ 50,000			$ 50,000	0.442	$ 22,100
2024				$ 50,000			$ 50,000	0.417	$ 20,850
2025				$ 50,000			$ 50,000	0.394	$ 19,700
2026				$ 50,000			$ 50,000	0.371	$ 18,550
2027				$ 50,000			$ 50,000	0.350	$ 17,500
2028				$ 50,000			$ 50,000	0.330	$ 16,500
2029				$ 50,000			$ 50,000	0.312	$ 15,600
2030				$ 50,000			$ 50,000	0.294	$ 14,700
2031				$ 50,000			$ 50,000	0.278	$ 13,900
2032				$ 50,000			$ 50,000	0.262	$ 13,100
2033				$ 50,000			$ 50,000	0.247	$ 12,350
2034				$ 50,000			$ 50,000	0.233	$ 11,650
2035				$ 50,000			$ 50,000	0.220	$ 11,000
2036				$ 50,000			$ 50,000	0.207	$ 10,350
2037				$ 50,000			$ 50,000	0.196	$ 9,800
2038				$ 50,000			$ 50,000	0.185	$ 9,250
2039				$ 50,000			$ 50,000	0.174	$ 8,700
2040				$ 50,000			$ 50,000	0.164	$ 8,200
2041				$ 50,000			$ 50,000	0.155	$ 7,750
2042				$ 50,000			$ 50,000	0.146	$ 7,300
2043				$ 50,000			$ 50,000	0.138	$ 6,900
2044				$ 50,000			$ 50,000	0.130	$ 6,500
2045				$ 50,000			$ 50,000	0.123	$ 6,150
2046				$ 50,000			$ 50,000	0.116	$ 5,800
2047				$ 50,000			$ 50,000	0.109	$ 5,450
2048				$ 50,000			$ 50,000	0.103	$ 5,150
2049				$ 50,000			$ 50,000	0.100	$ 5,000
2050				$ 50,000			$ 50,000	0.090	$ 4,500
2051				$ 50,000			$ 50,000	0.090	$ 4,500
2052				$ 50,000			$ 50,000	0.080	$ 4,000
2053				$ 50,000			$ 50,000	0.080	$ 4,000
2054				$ 50,000			$ 50,000	0.070	$ 3,500
2055				$ 50,000			$ 50,000	0.070	$ 3,500
2056				$ 50,000			$ 50,000	0.060	$ 3,000
2057				$ 50,000			$ 50,000	0.060	$ 3,000
2058				$ 50,000			$ 50,000	0.060	$ 3,000
2059				$ 50,000			$ 50,000	0.050	$ 2,500
2060				$ 50,000			$ 50,000	0.050	$ 2,500
2061				$ 50,000			$ 50,000	0.050	$ 2,500
2062				$ 50,000			$ 50,000	0.050	$ 2,500
2063				$ 50,000			$ 50,000	0.040	$ 2,000
2064				$ 50,000			$ 50,000	0.040	$ 2,000
2065				$ 50,000			$ 50,000	0.040	$ 2,000
Project Life: 50 years									
							Total Present Value of Discounted Costs (Sum of Column (i))		$ 11,738,144

Comments
Maintenance cost include weed abatement, inspection, and maintenance of the dam structure, monitoring and maintenance of the riparian restoration area (adaptive management), and maintenance of the inlets (trash removal) and emergency outlets (maintenance of hte gate and emergency spillway). All costs are in 2009 dollars.

Table 5

Present Value of Expected Annual Damage Benefits
(Values Generated Using FRAM Model)

(a)	Expected Annual Damage Without Project (1)		$1,855,781
(b)	Expected Annual Damage With Project (1)		$85,342
(c)	Expected Annual Damage Benefit	(a)- (b)	$1,770,439
(d)	Present Value of Future Benefits		15.76
(e)	Present Value of Future Benefits	(c) x (d)	$27,902,123

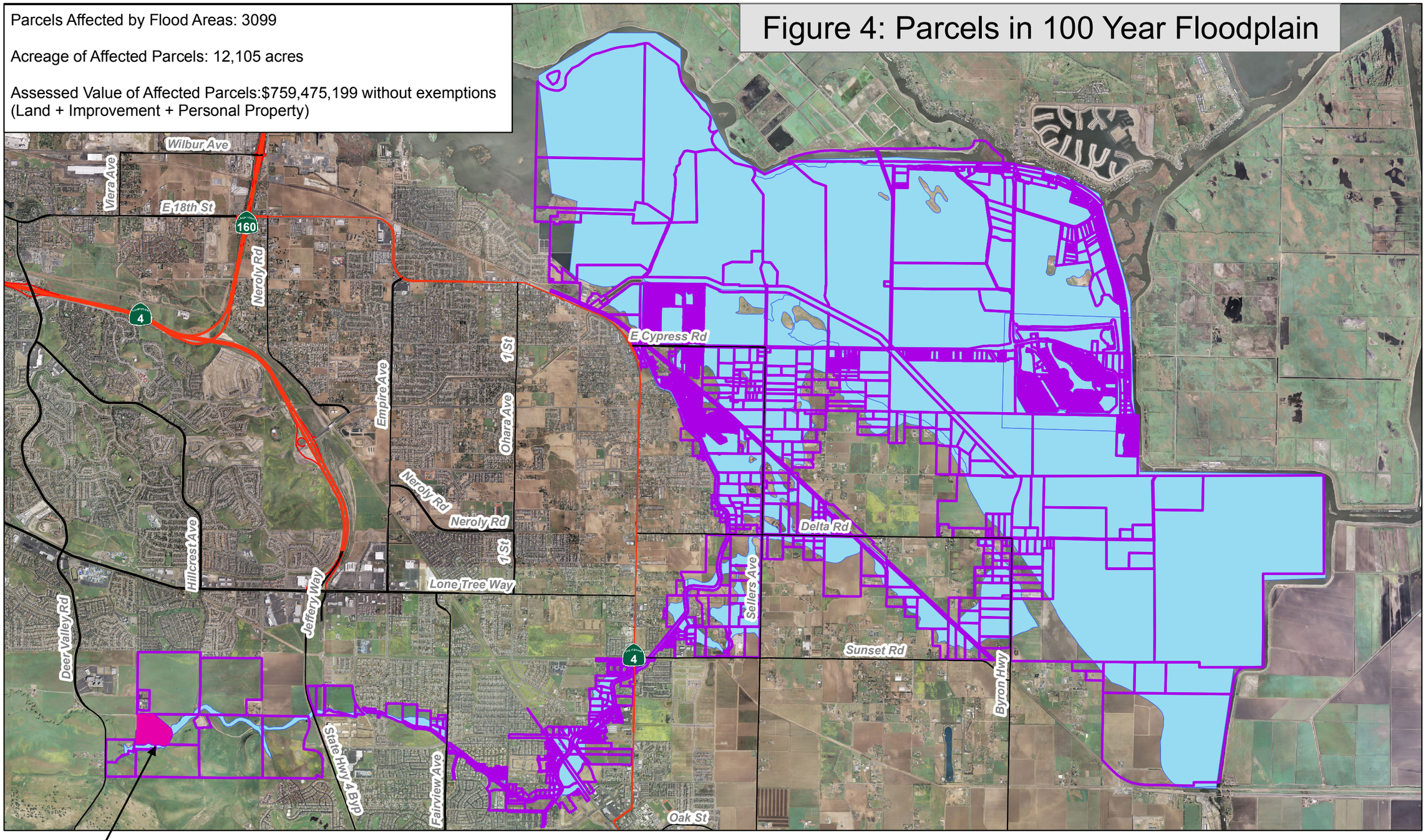
G:\fldctl\Watershed Planning - Engineering\DA 104 - Sand Creek\Upper SCB\Prop 1E Grant Application\Economic Analysis.docx

Figure 4: Parcels in 100 Year Floodplain

Parcels Affected by Flood Areas: 3099

Acreage of Affected Parcels: 12,105 acres

Assessed Value of Affected Parcels:$759,475,199 without exemptions
(Land + Improvement + Personal Property)



G:\fldctl\GIS\UpperSandCreek\Prop 1E Grant Application\Figure4ParcelsIn100YearFloodplain.mxd